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Dual-form Oral Vitamin C

New research in the UK and the USA has shown that a combination of two forms of vitamin C, taken by mouth, can achieve the high blood levels thought necessary to have an anti-cancer effect, which we previously thought only possible with large intravenous doses. We have worked with the researchers to bring this to patients. Please be clear; there are as yet no clinical trials of this regime in cancer patients; it is not "evidence-based medicine" (there are two clinical trials of *intravenous* vitamin C going on at present, that we know about).

Background

The use of vitamin C (ascorbic acid) in cancer is the legacy of Linus Pauling, twice Nobel Prize winner, who with Abram Hoffer invented the term "orthomolecular" for therapies using molecules that are familiar to the body. In the 1970's Pauling published, with Scottish surgeon Ewan Cameron, two studies [1,2] reporting that terminal cancer patients given 10 grams of vitamin C per day lived longer and had better quality of life. It is important to note that in these studies the vitamin C (intravenous at first, then oral) was used alongside surgery, radiotherapy and chemotherapy. Of the two studies at the Mayo Clinic [3,4] which have been claimed to refute the Pauling/Cameron hypothesis, one used vitamin C alone as the treatment, and the other gave it after chemotherapy had finished. At these doses (less than we use now), a major role for vitamin C will be supporting the immune system, and this is known to be damaged by chemotherapy. And Pauling and Cameron never recommended using vitamin C as the sole treatment; their papers referred to "supportive treatment".

Pauling and Cameron also gave the vitamin C intravenously at first, unlike the Mayo studies. More recently, studies at the USA National Institutes of Health came to the conclusion that it was only possible to achieve the high blood levels of vitamin C necessary to kill cancer cells by giving it intravenously [5]. But new research shows that it is possible to achieve these high blood levels by giving a combination of two forms of vitamin C by mouth –the "ordinary" water-soluble vitamin plus a new, liposomal (oil-based) form [6]. The two forms appear to be absorbed into the body by different routes, adding up to give a much higher level.

Some numbers; the kidneys will try to conserve vitamin C so the blood level does not go below about 70uM/L (micromoles per litre), and a daily intake of around 200mg is all it takes to maintain this level, which was originally thought to be a "saturation" level. Large oral doses (of "ordinary" vitamin C) will bring the level to 200 to 250uM/L, and this was thought to be highest level that could be achieved, except by large intravenous injections. The new study showed that using high doses (20-36G/day) of the liposomal form of vitamin C alone could achieve levels of 300-400uM/L. Combining the two forms enabled the researchers to obtain levels of 400-600uM/L. Other studies have shown in vitro (in the laboratory, not in real life) that a level of 400uM/L will kill about 50% of cancer cells in 1 hour [7].

Intravenous vitamin C can easily achieve high levels such as this, but only transiently. What happens if, using the two oral forms, you can maintain that sort of level for days on end, not just for an hour? In the laboratory the anti-cancer effect keeps on working; in real life nobody has yet shown what happens. We can only speculate that perhaps the same thing happens.

There are several compounds that appear to work synergistically with vitamin C against cancer; the most practical one to use, in terms of dosage and cost, is lipoic acid [8]. A new, demonstrably more potent form of this, known as R-lipoic acid, is now available. In vitro this reduced the level of vitamin C needed to achieve an anti-cancer effect by about a factor of five.

Interactions with chemo

Several researchers have suggested that antioxidant therapy (and vitamin C is classed as an antioxidant) may reduce the anti-cancer effects of chemotherapy and radiotherapy; this has generally been well-reported in the media, much more so than studies showing the opposite. Also, many of the well-reported studies have been laboratory studies, not clinical research. The chemistry of this question is complex, but the bottom line, I believe, is provided by a review paper in 2007 [9] which considered the 19 available controlled clinical trials and concluded; "None of the trials reported evidence of significant decreases in efficacy from anti-oxidant supplementation during chemotherapy. Many of the studies indicated that anti-

oxidant supplementation resulted in either increased survival times, increased tumor responses, or both, as well as fewer toxicities than controls". They did warn that "lack of adequate statistical power was a consistent limitation", but nonetheless, a 19 out of 19 result is a strong finding.

There are two "buts"; the first is that there is some evidence that *low doses* of antioxidants given infrequently or just once before treatment may indeed protect cancer cells against chemotherapy [10], while high doses do not. This is counter-intuitive, and concerning — firstly because some doctors have advised patients to take only low doses of antioxidant nutrients, and secondly because ⅔ of cancer patients take supplements, and most of their doctors do not know they are doing so [11]. You need the advice of a doctor experienced in this area.

The second issue concerns the B vitamin folic acid (folinic acid, methyltetrahydrofolate); there is evidence that this can increase the toxicity of certain anti-cancer agents, as well as a suggestion in the literature that supplements of this might increase the risk of developing cancer. Therefore we do not recommend it unless there are specific reasons why it is needed, and no reasons not to take it.

How does it work?

Although vitamin C is known as an antioxidant, the study from the NIH in the USA [7] revealed "an unanticipated role in cancer treatment". They found that vitamin C produced hydrogen peroxide, a strong oxidant, within tumours, which selectively killed the cancerous cells. No peroxide was formed in normal cells, and they were not harmed. This was a laboratory study, of course, not a clinical trial, but it does seem to explain how vitamin C can attack cancer cells specifically.

The effect may be enhanced by the fact that cancer cells have a strong affinity for glucose (sugar), and have a large number of channels that allow glucose into the cell. Ascorbic acid is a similar molecule to glucose, and is in fact made from glucose by all those animals that can make their own, which doesn't include humans. Vitamin C is taken up by those channels, leading to a higher concentration of vitamin C inside the cell. This also means that if sugars are around in your bloodstream in high quantities, they will get into the cancer cell instead of vitamin C. It is recommended that you avoid sugars as far as possible the whole time you are on the regime, and especially around the times that you take the vitamin C.

References

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I am grateful to Steve Hickey and Hilary Roberts (see reference 7) for the development of the concepts that underpin this, and for demonstrating that high ascorbate levels could be acheived orally.

The regime

Before starting
You must discuss this with your oncologists; please show them this to explain what is proposed.

We need to do a simple blood test called a G6PD before you start the full regime; an abnormality in this could mean that large quantities of vitamin C would be harmful to you.

Starting
Everybody is different, and we will need to tailor the supplement regime to your circumstances, but a typical regime might look like this;

Treatment	Breakfast	Lunch	Dinner	Bedtime
Ascorbic acid powder - teaspoons	1	1	1	1
Liposomal vitamin C - sachets	4	4	4	
R Lipoic Acid - capsules, 150mg	1	1	1	

The water-soluble ascorbic acid powder has a short half-life in the body, so it needs to be taken frequently, around every 6 hours. Many people find it best to dissolve the day's dose in a litre or so of pure water, and sip it throughout the day. It can also be taken in fruit juice or any cold or warm beverage (not hot). 1 rounded teaspoon is about 5 grams; you probably need to take about 20 grams across the day.

The oil-soluble (liposomal) form stays in the body longer, and a twice or three times daily dose is adequate. Each sachet contains 1 gram; the target is usually 12 grams per day.

The lipoic acid can be taken 3 times per day.

As with any high-dose treatment, it is best to allow your digestion time to "get used to" the new compounds; start with a small dose, perhaps ¼ of the above, and build up over 1-2 weeks to the full dose.

Remember to stay off sugar and refined carbohydrates. Complex carbohydrates such as wholegrains are fine.

Carrying on
When you are "up to speed" we will take a blood sample to check whether your ascorbate level is in the target range, and adjust your doses accordingly.

Report any problems to us so we can deal with them.